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NAVAL WAR COLLEGE
Newport, R.I.

The C4I Strategic-Operational Link and Future Developments Impacting the Operational Commander.

by

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Major, U.S. Army

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Maritime Operations Department.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College, the Department of the Navy or the Department of the Army.

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17 June 1994

Approved by:

R. Allen Ricketts 4 Feb 94
Roger A. Ricketts, COL, USA Date
Faculty Research Advisor

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: UNCLASSIFIED

1b. RESTRICTIVE MARKINGS:

2a. SECURITY CLASSIFICATION AUTHORITY:

2b. DECLASSIFICATION / DOWNGRADING SCHEDULE:

3. DISTRIBUTION / AVAILABILITY OF REPORT: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

4. PERFORMING ORGANIZATION REPORT NUMBER(S):

5. MONITORING ORGANIZATION REPORT NUMBER(S):

6a. NAME OF PERFORMING ORGANIZATION: OPERATIONS DEPARTMENT

6b. OFFICE SYMBOL *(If applicable)*: C

7a. NAME OF MONITORING ORGANIZATION:

6c. ADDRESS *(City, State, and ZIP Code)*: NAVAL WAR COLLEGE NEWPORT, R.I. 02841

7b. ADDRESS *(City, State, and ZIP Code)*:

8a. NAME OF FUNDING / SPONSORING ORGANIZATION:

8b. OFFICE SYMBOL *(If applicable)*:

9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER:

8c. ADDRESS *(City, State, and ZIP Code)*:

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO	WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*: THE C4I STRATEGIC-OPERATIONAL LINK AND FUTURE DEVELOPMENTS IMPACTING THE OPERATIONAL CDR (U)

12. PERSONAL AUTHOR(S): MAJ DAVID P. THORESEN, USA

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15. PAGE COUNT
FINAL	FROM ______ TO ______	8 FEB 94	42

16. SUPPLEMENTARY NOTATION: A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Operations. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

17. COSATI CODES

FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*: OPERATIONAL COMMANDER; TECHNOLOGY; APPLICATION; IMPACTS

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

TECHNOLOGY DEVELOPMENTS WITHIN THE COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS AND INTELLIGENCE (C4I) AREA ARE RAPIDLY CAUSING CHANGES THROUGHOUT THE WORLD. U.S. OPERATIONAL COMMANDERS SHOULD REAP BENEFIT FROM THESE ADVANCES. HOWEVER, THE FACT WE CAN DISSEMINATE MORE INFORMATION, FASTER, AND TO A WIDER AUDIENCE IS NOT THE ONLY MEASURE OF EFFECTIVENESS. RECENT EXPERIENCES DURING THE GULF WAR, SOMALIA, AND IN DEVELOPMENT OF CONTINGENCY PLANS, HAVE SHOWN THE DRAMATIC ROLE C4I CAPABILITIES CAN HAVE AT THE OPERATIONAL LEVEL. FUTURE OPERATIONS ACROSS THE SPECTRUM OF CONFLICT WILL CONTINUE TO DEMAND MORE IN THE FORM OF C4I SUPPORT. THE CONCEPT OF FORWARD DEPLOYED FORCES IS SHIFTING TO FORCE PROJECTION FROM THE CONTINENTAL UNITED STATES. COUPLED WITH RESOURCE CONSTRAINTS, THIS SHIFT REQUIRES C4I EMPLOYMENT CONCEPTS AND ARCHITECTURES TO CHANGE. THESE CHANGES ARE REPRESENTED IN CONCEPTS SUCH AS THE JOINT STAFF'SC4I FOR THE WARRIOR AND THE U.S. ARMY'S ENTERPRISE STRATEGY. ARCHITECTURAL CHANGE, SUCH AS THE NEW U.S. ARMY INTELLIGENCE AND SECURITY COMMAND'S (INSCOM) INFORMATION MANAGEMENT ARCHITECTURE (IMA), IS BEGINNING TO FOCUS TECHNOLOGY ADVANCES ON TO EQUIPMENT AND FORCE STRUCTURE.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT: ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS

21. ABSTRACT SECURITY CLASSIFICATION: UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE *(Include Area Code)*	22c. OFFICE SYMBOL
CHAIRMAN, OPERATIONS DEPARTMENT	841-3414	C

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete

☆ U.S. Government Printing Office: 1985—639-012

0102-LF-014-6602

Abstract of

THE C4I STRATEGIC-OPERATIONAL LINK AND

FUTURE DEVELOPMENTS IMPACTING THE OPERATIONAL COMMANDER

Technology developments within the Command, Control, Communications, Computers and Intelligence (C4I) area are rapidly causing changes throughout the world. U.S. operational commanders should reap benefit from these advances. However, the fact we can disseminate more information, faster, and to a wider audience is not the only measure of effectiveness. Recent experiences during the Gulf War, Somalia, and in development of contingency plans, have shown the dramatic role C4I capabilities can have at the operational level. Future operations across the spectrum of conflict will continue to demand more in the form of C4I support. The concept of forward deployed forces is shifting to force projection from the Continental United States. Coupled with resource constraints, this shift requires C4I employment concepts and architectures to change. These changes are represented in concepts such as the Joint Staff's C4I for the Warrior and the U.S. Army's Enterprise Strategy. Architectural change, such as the new U.S. Army Intelligence and Security Command's (INSCOM) Information Management Architecture (IMA), is beginning to focus technology advances on to equipment, deployment methods, and force structure. The focus of all these efforts is the link between strategic resources and the operational commander. Barriers to fully integrating strategic and operational C4I capabilities do exist. C4I vulnerabilities, Multi-level security, joint interoperability, and integrating U.S. and coalition forces continue to be issues that will demand the attention of C4I planners and operational commanders of the future.

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INTRODUCTION

Technology developments within the Command and Control, Communications, Computers and Intelligence (C4I) area are precipitating changes throughout the world. U.S. military operational commanders should reap benefit from these advances. However, several questions arise regarding the application of this technology to support the operational commander. How are current concepts and architectures linked to the operational commander? Are there tradeoffs between operational effectiveness and technologic efficiency? What impact may future coalitions, U.S. inter-agency operations, and threat capabilities have on C4I support at the operational level? Should the fact that we can disseminate more information, faster, and to a wider audience be the only measure of effectiveness?

SIGNIFICANCE OF TECHNOLOGY CHANGE

During Operations DESERT SHIELD and DESERT STORM, evidence of the vast changes within the C4I arena became strikingly clear. Telecommunication assets within both the military and commercial realms rapidly alerted not only commanders and potential target areas of SCUD launches, but also flashed around the world live images of the final moments of the warheads' flights. Air and guided missile strikes on Baghdad were brought into the world's living rooms, and military operation centers worldwide.

Mobile commercial telephone "stations" were provided by commercial firms, permitting U.S. military personnel access to telephone home. Electronic mail networks worldwide responded to the demand for access

between soldiers, family, and a supportive public at home. The utility of network electronic mail was also exploited by the U.S. military and other governmental agencies throughout the crisis.

Satellite communications and the significance of space platforms for reconnaissance were also evident throughout DESERT SHIELD and DESERT STORM. Detection of SCUD launches, identification of SCUD facilities, target development, Battle Damage Assessment (BDA) efforts, unit positioning and reporting capabilities were heavily reliant on spaceborne platforms.

These military and commercial technology applications are representative of the rapid and evolutionary changes impacting modern warfare. However, some of the fundamental problems of these technological applications became apparent during operations DESERT SHIELD and DESERT STORM. These problems continue to surface as issues relevant to the effective employment of U.S operational forces.

Telecommunications interoperability was a deep concern during the planning and execution of operations DESERT SHIELD and DESERT STORM. Telecommunications interoperability between the U.S. military services was widely accepted as a major shortcoming following operation URGENT FURY (1982). This issue remained a strong concern during the planning and execution of operation JUST CAUSE (1989-90). New symptoms of the problem resurfaced again during DESERT STORM. For example, the coordination and dissemination of the daily Air Tasking Orders (ATOs) between Air Force and Navy air command structures required that hard copy of the ATO be air couriered. ^1

Additional interoperability issues surfaced as U.S. and coalition forces worked through the problematic areas of linking various

telecommunications assets and determining how secure communications could be established without compromising Communication Security (COMSEC).

Operation JAYHAWK THUNDER from the Gulf War exemplifies a shortfall in basic telecommunications capability that continues to demand attention as the U.S. seeks to harness the technology advances. Appendix A, an extract from the U.S. Army Vision concept, provides a synopsis of the JAYHAWK THUNDER operation. The thrust of the analysis of this operation is that a break in communications with units on the move can reduce the effect of the synthesis created by rapid target identification, fire support and power projection in the deep battle. Although this operation was successfully executed, the effectiveness of the operation was a result of initiative and a "work-around" to existing C4I architecture. ^2

Initiative and dynamic "work-arounds" were not limited to combatant forces during operations DESERT SHIELD and DESERT STORM. The challenge of linking national assets and intra-governmental agencies to the operational commander also resulted in similar occurrences. Linking national intelligence data bases, imagery data bases, and establishing communication links to agencies such as the State Department and Central Intelligence Agency (CIA) field stations are just a few of the examples where use of existing commercial capabilities were quickly adapted to meet operational requirements. Many of these temporary or quick reaction contract (QRC) capabilities are now formalized as recognized requirements within the Department of Defense.

Military operations throughout history have yielded new appreciations of both potential shortfalls and increased capabilities resulting from the application of technology advances. Much of the attention after operations

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DESERT SHIELD, and DESERT STORM focused on the United States' technological prowess. However, a balanced analysis of technology must also take into account the potential of an adversary to exploit the same advances in technology.

Latin American druglords use of high-tech communications and radar equipment, and more recently the Somali warlord Aideed's use of cellular satellite communications is noteworthy. Technological change in today's world benefits the Superpower and mini-power alike. Assessing capability and exploitability of technology is not a one-sided activity. As the United States military develops strategies to take advantage of technological advances, threat capability must be assessed in order to determine how best to provide increased capabilities to the operational commander.

THE FUTURE

Technology advances have substantially decreased the physical size of equipment, while simultaneously expanding the processing capabilities. There is little reason to suspect this trend will abate. Theater-level intelligence fusion telecommunications and computer processing equipment once required environmentally controlled forty foot trailers. These are now being reduced to suites of equipment packaged in vehicles the size of tactical ambulances. Proliferating more systems throughout the battlefield, or even fielding more mobile systems, is only a small part of the solution to meeting the diverse requirements of future joint operations. [3]

CHAPTER 1 - THESIS & SIGNIFICANCE OF TECHNOLOGY CHANGE

Lieutenant General Edmonds, (Director, Command, Control, Communications, and Communications, J6) provides the following assessment of the future demands on the Joint C4I architecture.

> "At a time when the Warrior's job is likely to be a crisis response in a politically uncertain world, a resolute commitment by the Joint Staff, combatant commanders (CINCs), Services, and Defense agencies to the vision of total C4I interoperability provides C4I stability and assurance to the joint Warrior. Even though fewer warfighters and fewer weapons may be available, their most effective use will be realized in joint operations when the vision of C4I for the Warrior has been achieved in the Objective Phase." ^4

C4I for the Warrior is a concept developed as a "...roadmap to focus unity of effort within the C4I community." ^5 The significance of this concept is in the attempt to focus unity of effort in a future environment of budgetary and force level constraints. Unity of effort, or Jointness and Joint interoperability, is certainly not a new idea. However, the recent doctrine and concepts development within the Department of Defense and other national agencies is placing renewed emphasis on Joint development efforts. This is as much a function of shrinking resources as it is a function of the increased feasibility offered by technology expansion. The efficiency of technology exploitation has become as critical as the effectiveness of the systems being developed.

CHAPTER 1 - THESIS & SIGNIFICANCE OF TECHNOLOGY CHANGE

The recent concept, guidance, and doctrinal developments go well beyond simply advocating Joint interoperability. These efforts also go beyond the sphere of technology normally associated with telecommunications. The objective of these developments can best be described as a full integration of command and control, combat weaponry, combat support, and combat service support systems. For example, the U.S. Army's vision of this concept includes the "digitization of the battlefield...(to provide)...the Warfighter an integrated digital information network that supports the warfighting systems..."[6] The U.S. Navy's "Copernicus" and the U.S. Air Force's "Theater Battlefield Management" are similarly focused concepts. Providing the operational warfighter a qualitative and decisive edge represents the future of all C4I efforts.

CHAPTER 2 - C4I ARCHITECTURE LINKED TO THE OPERATIONAL COMMANDER

DOCTRINAL LINKAGE

The focus of current U.S. national military C4I doctrine is to provide "...full functional integration of C4I for the [Commander Joint Task Force] CJTF..." ^1 This doctrine represents the linkage from the National Command Authority, as expressed in the National Military Strategy Document, to the Services and Operational Commanders.

> "Secretary Aspin has directed the armed forces to maintain the technological superiority that contributed so effectively to victory in Desert Storm an other recent military operations. A key element of that superiority is our capability to command the high ground of space early warning, intelligence, weather, surveillance, navigation, and command, control and communications." ^2

Because of the significance of Spaceborne platforms to the overall capabilities of the U.S. military, the doctrine also serves to establish the linkage between the National Space Policy,the Defense and Service Space policies, and the operational commander's anticipated requirements for Spaceborne assets.

CHAPTER 2 - C4I ARCHITECTURE LINKED TO THE OPERATIONAL COMMANDER

THE JOINT STAFF's "C4I FOR THE WARRIOR"

The C4I for the Warrior concept addresses the ongoing efforts to improve operational effectiveness through developments in technology. Particular emphasis is placed on the need to increase the effectiveness of Joint C4I systems through efforts to increase both the vertical and lateral capabilities of the C4I systems available to the commander. Barriers to truly interoperable and effective systems do exist in the form of unique Service, CINC, and functional area stove pipe systems. Technology limitations, as well as past doctrinal and procedural practices, serve to perpetuate many of these stove pipe systems. ^3

The overall effectiveness of the C4I architecture and individual systems is being incrementally increased. Bandwidth compression techniques are being implemented that increase the effective capacity of a communications link by as much as a factor of 4. Technology advances in dynamic bandwidth management techniques that allocate portions of the communications link on a priority or time share basis permit a typical 64 kilobit (KB) tactical satellite link to carry a great deal more information today than was possible 5 years ago.

As computers have become faster and smaller the ability to move larger quantities of information to operationally deployed forces has increased. Simultaneously, updating this information has become more efficient by linking these more capable computers in networks that take full advantage of previously mentioned bandwidth management systems. A computer need not have constant data connectivity to a distant network or computer to perform

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its function. It may only require periodic communications access to accomplish updates of stored information. These periodic updates may be accomplished by a time allocation or priority scheme. The net effect is more efficient use of communication links. To the operational commander, this equates to more information capability within the deployed force for the same or lesser quantities of physical communication links.

Advances are being made, but substantial barriers remain. These include the issue of Multi-Level Security within integrated telecommunications networks, software compatibility, and procedural barriers to fully integrated access to national strategic assets. Further technology advances will be required to attain a fully integrated architecture. It is for precisely this reason the <u>C4I for the Warrior</u> concept places a premium on the issue of efficiency within the C4I architecture. Included in this goal of increased efficiency are development and implementation efforts, as well as the short and long term resource allocation issues associated with restructuring the C4I capabilities. ^4

LINKING THE ARMY

> "The Army Enterprise Strategy is the single, unified vision for the Army C4I community...It synchronizes Army programs with the Joint Staff's C4I for the Warrior concept, business practices, and the Defense Information Infrastructure." ^5

CHAPTER 2 - C4I ARCHITECTURE LINKED TO THE OPERATIONAL COMMANDER

The Army Enterprise Strategy was disseminated in late summer of 1993 in a document titled The Vision. The strategy describes ten principles by which the Army seeks to support battlefield information management. These principles are:

1. Focus on the Warfighter
2. Ensure Joint Interoperability
3. Capitalize on Space based assets
4. Digitize the Battlefield
5. Modernize Power Projection Platforms
6. Optimize the Information Technology Environment
7. Implement Multi-Level Security
8. Ensure Spectrum Supremacy
9. Acquire Integrated Systems Using Commercial Technology
10. Exploit Modeling and Simulation ^6

In addition to linking the Joint Staff's guidance to the Army programs, the Enterprise Strategy links C4I architecture to the way in which the Army will fight in the future. The strategy was developed concurrently with the revision of the warfighting doctrine expressed in the Army Operations Manual, FM 100-5, published in July 1993. ^7

On 21 December 1993, the office of the Army Director of Information Systems for Command, Control, Communications and Computers (DISC4),

released for coordination the follow on draft implementation plan, The Army Enterprise Strategy Implementation Plan. The draft plan contains 20 formal tasks that will be the basis for the Army's implementation of the 10 principles relevant to the Army's C4I architecture. A review of the 20 tasks reveals the broad scope of the implementation plan. Technological change within the C4I arena will compel change throughout the Army. The implementation plan includes taskings to U.S. Army organizations responsible for changing doctrine, training, operational guidance, funding, acquisition and integration strategies, in response to proposed employment of new C4I technology. Each of the designated organizations are formally assigned responsibilities which will lead to the establishment of priorities for technological advances within the U.S. Army's Modernization Plan (AMP). Appendix B lists each of the implementation tasks and identifies the lead Army command or agency. ^8

Both The Vision and the Enterprise Strategy Implementation Plan (Draft) stress the importance of C4I architecture and the employment of technology advances as force multipliers. In this context, the effectiveness of C4I technology advances are not measured independently, but as a function of their contribution to the entire Army's capability. Likewise, the efficiency of a given procurement strategy, employment methodology, and system will be evaluated in the context of a "...reengineered Army Enterprise." ^9

CHAPTER 2 - C4I ARCHITECTURE LINKED TO THE OPERATIONAL COMMANDER

SYNERGISTIC TECHNOLOGY APPLICATION

The term, battlespace, is a relatively new descriptor of the area a commander is concerned with during the conduct of military operations. Nonetheless, the use of new technology to provide a clearer picture of the operational area is evident throughout military history. "Battlespace management" existed long before the terminology. During the American Civil War, observers and cameras were used aboard helium filled balloons. In effect, this was an early attempt to provide real-time aerial reconnaissance to the military commanders of Union forces. ^10

During World War I, the integration of photographic equipment into the airplane provided commanders a deeper view of battlefield. By the close of World War I, this technology was capable of providing ground commanders with photographic intelligence within as little as 20 minutes from the aircraft's time over target. This intelligence could then be provided to supporting artillery batteries within minutes via telegraph. This was an effective merge of technology to increase the relative combat power of the operational commander. ^11

A striking point results from a comparison between operation JAYHAWK THUNDER of the 1990's and the efforts to link aerial reconnaissance to fire support during World War I. Seventy years of technology advancements, centralized coordination and control systems, advanced detection systems, rapid dissemination capability, and technically efficient systems do not necessarily result in a synergistic effect. Synergism is defined as " cooperative action of discrete agencies such that the total effect is

greater than the sum of the effects taken independently". ^12 The synergistic effect resulting from operation JAYHAWK THUNDER occurred in spite of the existing architecture, not as a result of it.

OBJECTIVE OF THE ARCHITECTURES

Reliable and consistent gains in the effectiveness of combat power due to the synergistic employment of new technology are a product of the overall architecture in which these technologies are employed. The architecture is more than a product of foreseeable technology changes. Shortfalls and vulnerabilities are also an integral part of assessing the overall capability of the architecture.

The architecture, and analysis of technology to support that architecture, is a product of the social and political environment in which the military must plan. One writer, on measuring the efficacy of telecommunication architectures, has pointed out, "... technological systems have to be assessed in the operational context formed by the military concept in which they are to be applied" ^13

Operational planning centering around forward deployed forces is being replaced by the concept of force projection. Therefore, the context for evaluation of all military systems is changing to the demands of force projection. This is the central theme in C4I concepts and architectures being developed within the Department of Defense.

CHAPTER 3 - RELATING TECHNOLOGY CHANGE TO THE OPERATIONAL COMMANDER

PARADIGM SHIFTS

The authors of the U.S. Army Enterprise Strategy Implementation Plan use the term "Paradigm shift" extensively in illustrating the reason for change within the C4I architecture of the Army. The summation of these shifts are that as the threat to U.S. global interest changes so does the way in which the U.S. military must operate. Once the context of military operations changes, so must the methodology of choosing and employing C4I technology. ^1

The layered theater C4I infrastructures that existed with large forward deployed forces have become obsolete in light of the constrained lift capability available to execute force projection. The response has been to increase the reliance on commercial telecommunication links. Theater unique solutions are being replaced by an emphasis on global solutions. Communications systems designed to interface to Corps and Echelon Above Corps (EAC) systems are now being linked directly to military and commercial telecommunication networks with global connectivity. ^2

The lifecycle of technology improvements is constantly shrinking. Combined with constrained financial resources and an increase reliance on technology as a force multiplier, the technology lifecycle issue is driving major reviews and radical shifts in system acquisition, training, logistics, and doctrine. The response to date has been an increased reliance on Commercial Off-The-Shelf (COTS) acquisition strategies, increased commercial maintenance in lieu of military maintenance personnel,

throw-away component replacements, and much broader assessments of the impact a particular C4I requirement may have within the Department of Defense.

NEAR TERM IMPACTS

An example of a near term impact of technology and C4I architectural change is the architecture, deployment concepts, and equipment fielding within the U.S. Army intelligence community. The U.S. Army Intelligence and Security Command (INSCOM) Information Management Architecture (IMA) approved in October 1993 was developed in close coordination with both the C4I architectural changes and the doctrinal revisions of Army Operations manual FM100-5. The new IMA reflects a shift from past efforts that focused heavily on support to national and strategic information systems, with support rendered to the operational forces on a theater or situational unique basis. Support and capability were closely tied to each theater's characteristics, and varied greatly between theaters. Support rendered to U.S. Southern Command (SOUTHCOM) bore little resemblance to that available to support U.S. Forces European Command (EUCOM). Support to contingency operations was more a function of availability of the latest technological devices', than a planned support package based on established requirements. Appendix B contains graphic representations of elements of the U.S. Army INSCOM IMA. Of note is the emphasis placed on establishing requirements, the flexibility of proposed support, and lack of dependency on any given theater's existing telecommunications infrastructure. ^3

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The INSCOM architecture recognizes the demands of force projection, and attempts to accommodate these with a tiered response of C4I assets. This tiered response provides the operational commander a rapid deployment capability, as well as flexible follow on capability. Access to Army, joint and national intelligence assets are provided with a Tier I Intelligence Support Element that can be airlifted in a single C-141. Thus, both flexible response and support to adaptive planning are served. The operational commander, regardless of theater or level of conflict, is provided a standardized support package. The multiple levels of access provided to an operational force, from the Army component, Joint theater, Department of Defense, and national intelligence systems, increases the overall effectiveness of the support . ^4

Technology advances have, and will continue to play, a significant role in INSCOM's efforts to support the operational commander. The Intelligence Support Element (ISE) is currently a deployable asset. The technical capability and the doctrinal employment scheme for this element simply did not exist prior to operations DESERT SHIELD and DESERT STORM. The Trojan Spirit satellite system was a direct result of Quick Reaction Contract (QRC) efforts initiated during early stages of the Gulf War. Trojan Spirit is now a key component of the rapid deployment capability of the ISE. The Trojan Spirit satellite terminal is capable of establishing satellite communications in one of several bandwidths (Defense or leased commercial satellites) and linking the operationally deployed forces with defense, national and global intelligence communication networks. The employment concept is a direct derivative of technology advances and the linkage

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established within the developing C4I architectures of Department of Defense agencies. ^5

Additional shifts are in evidence throughout the linkage of the previously mentioned concepts and architectures to Continental United States (CONUS) based facilities as "...power projection platforms..." ^6 These shifts focus on many of the issues associated with force projection and the operational commander. To effectively meet the operational challenges of force projection in an uncertain and resource constrained environment, much of the intelligence fusion support, logistics support and staff functions will be CONUS based. The CONUS bases of support are linked to the forward forces via C4I assets. This shift is heavily dependent on spaceborne platforms and the reliability of C4I systems. A trade-off is apparent. Acceptance of a level of risk in effectiveness is accepted to further the efficient use of constrained resources. Much of the envisioned efforts to attain the future architectural objectives will be focused on mitigating this risk.

FUTURE IMPACTS

Operational commanders are faced with planning for missions spanning the spectrum of conflict from Major Regional Conflict (MRC) to Operations Other Than War (OOTW). The recent emphasis on, and predictions that future U.S. military involvement will be centered toward, the lower end of the conflict spectrum does not obviate concerns with employing C4I systems. The "tooth to tail" ratio and availability of appropriate C4I equipment within the

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selected force structure for a given operation remain significant planning issues. During the early operations of the JTF in Somalia, the U.S. Army "...10th Signal Battalion provided theater communications support with over 600 personnel assigned from 12 different signal battalions." ^7 Increased requirements to access CONUS based support facilities and provide additional access to non-DOD agencies will continue to increase the complexity of the employment of C4I assets.

In a resource constrained environment, one critical facet of future technology implementation will be the development of dual-use technology.^8 Advances within the C4I architecture will be tied to such dual use technology as artificial intelligence, high definition video graphics, the Integrated Service Digital Network (ISDN), Broadband-ISDN (BISDN), Multi-Service Networks (MSN), and Universal Broadband Networks (UBN). These technologies are all contemporary concepts and/or components of what is being referred to as the "Information Superhighway". Highlighted among the advantages of this technology are the diversity of services provided within a single network, the consolidation of multiple network accesses to a single access point, and customer control in managing their virtual network. As telecommunication networks merge, physical access at one point on one network will allow access to all the users of the merged networks. Access to multiple users or agencies becomes possible without having to establish separate and distinct communication links with each. Virtual network in this sense represents a subset of all the individual users or agencies on the merged networks. The subset is the specific users to which an operational force may require access. The subset, or virtual network,

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may expand or contract based on the needs of the operational force --- not solely on the physical communication lines between the force and a desired geographical point. As networks merge the number and size of telecommunication equipment assemblages that must be moved with the operational force will be reduced. Both the flexibility and mobility of C4I systems will be enhanced as this new technology is implemented.

In addition to technology barriers to attaining the objectives described within the C4I for the Warrior concept, there are also some very real political and procedural concerns that will impact the operational commander. The impact on operational commanders is acute in the area of combined operations. Interoperability becomes an issue beyond simply technical structuring of capability.

> "The command and control of a combined operation requires consideration of all issues that arise in a joint operation, but in addition, requires coping with national aspects of communications security and of intelligence sources, as well as the impact of national pride. The interoperability problems that can arise during combined operations with third-world nations may be very great indeed." ^9

Replacing the Worldwide Military Command and Control System (WWMCCS) with the Global Command and Control System (GCCS) and the integration of command Local Area Networks requires standardization of C4I protocols and

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network structures that were formerly geographically or command specific. One potentially useful step in this process would be the release of NATO standards to non-NATO allies. ^10 However, the release of, and to a greater degree the acceptance of, standards is not solely within the purview of the United States.

The possibility of a disparity between U.S. forces' and other combined forces' technical capabilities will continue to impact operational commanders in the future. With the increased reliance on technology as a force multiplier, how will U.S. forces integrate into combined operations? Will the operational commander have to plan to the capabilities of the least common denominator? Will chopping U.S. C4I assets to the members of combined forces be possible? Will interfaces be required that permit backward compatibility to the technology level of allied forces?

The answer to these questions will be a product of the future technological state of the combined forces, doctrine, political considerations, and to a very significant degree the planning of the operational commander. General Robert RisCassi, a former Commander in Chief of the United Nations and the Republic of Korea (ROK) - U.S. Combined Forces Command has captured the dilemma facing future U.S. C4I planners and operational commanders when he stated:

> "It is in the various functions embedded in C4I that the American forces possess some of their greatest advantages on the battlefield...as we continue to improve our capabilities for collecting, analyzing, and

disseminating intelligence, managing the vast amounts of information upon which decisions are made and incorporating more and more computer aids to the battlefield decision and execution process, we must exercise care that these systems do not evolve into exclusionary processes. Unless the architecture incorporates the ability to share with, and in turn receive from, other national forces, the battlefield will not be seamless and significant risks will be present."[11]

CHAPTER 4 - CONCLUSION

CONCLUSION

The desired future impact of technology advances in support of the joint operational commander is to increase the effectiveness of the decision making - action cycle by providing a more accurate representation of Battlespace to the operational commander.

Increasing information flow throughout the Battlespace is more than a function of technical feasibility. Prioritization and structuring of this flow must be inherent in the C4I architecture to insure this flow supports the needs of the operational commander.

Concept, architecture, doctrinal development, and modeling attempt to identify the problems and propose approaches to resolution. Much effort throughout the C4I community is being expended to refine these areas in light of the new military environment of force projection. A glimpse of the complexity and broad impact of technology integration has been provided in the methodology associated with each of the reviewed concepts, architectures and implementation plans. The operational environment, political concerns, technology assessment, force structure, doctrine, acquisition strategies, funding, modeling and exercise requirements are all inter-related to the future C4I support provided to the operational commander.

APPENDIX A - OPERATION JAYHAWK THUNDER

Extract From U.S. Army THE VISION, page 7-8.

In the early stages of Desert Storm, the Army's VII Corps Artillery command post received intelligence reports on an Iraqi SA-2 Surface to Air missile site southwest of Basra. At the time, it wasn't considered a high payoff target. But during the ground offensive, when B-52 strikes were planned for the "highway of death," the SA-2 site posed a real threat to friendly aircraft and operations of the 1st Armored Division.

On 26 February 1991, the VII Corps G2 passed this information to the VII Corps Fire Support Element (FSE). Other sources of intelligence information verified that the SA-2 site was active and posed a lethal threat against a planned B-52 bombing raid. Responsibility for firing the mission was given to VII Corps FSE.

Repeated attempts to communicate with the 75th field Artillery Brigade failed due to the distance between the Brigade and the Corps tactical operations center. All day on 26 February, units of the Brigade were fighting and moving fast as they reinforced the fire of the 1st Armored Division Artillery and provided general support to VII Corps. Unable to contact the 75th FA Brigade, the VII Corps FSE sent a message to an Air Force EC-130E Airborne Command and Control Center, code named Alley Cat, asking it to relay the fire mission to the 75th FA Brigade. Alley Cat successfully contacted the Brigade at 1550.

Corps Artillery intelligence continued to verify the location and activity at the Iraqi site. A target grid was passed to the JSTARS Ground Station Module requesting verification that the target was still functional. Flying in Alley Cat, Major Gerald Hauck, the Army ground liaison officer, contacted the command element of the 75th FA Brigade. He issued a warning order for the fire mission on the SA-2 site, but did not establish a launch window. Since the Brigade was moving and did not have communications with Corps Artillery, the Commander, Colonel Jerry Laws, asked Alley Cat for confirmation of the mission. Major Hauck confirmed that VII Corps had cleared the mission and that he was working on airspace clearance with AWACS.

75th FA Brigade assigned the mission to A Battery, 6th Battalion, 27th Regiment. The commander, Captain Jeff Lieb, ordered an MLRS launcher to download rockets and upload missiles for an immediate Army Tactical Missile System (ATACMS) mission.

At this point Staff Sergeant Brault, the section chief, broke his MLRS launcher away for the Battery convoy and set up a firing point 75 to 100 meters away. Four ATACMS pods were delivered by the ammunition platoon. Two missiles were uploaded and the launcher was laid on target.

Meanwhile AWACS cleared the airspace an initial launch window. Alley Cat sent the launch window and refined target data to the 75th FA Brigade at 1650. Final firing data was computed at the Fire Direction Control Center, and relayed to Staff Sergeant Brault who entered the data into the MLRS. At 1705 Alley Cat relayed final authorization to fire from VII Corps to 75th FA Brigade.

At 1709, Sergeant Brault successfully launched two ATACMS missiles. The brigade commander, Colonel Laws, reported "SHOT" to Major Hauck. Damage assessment later showed the SA-2 site destroyed.

APPENDIX B
ARMY ENTERPRISE IMPLEMENTATION PLAN TASKS

Task 1: TRADOC, ISC, INSCOM, and Space and Strategic Defense Command combat developers will develop the Army's Enterprise C4I Operational Architecture.

LEAD AGENCY: TRADOC (U.S. Army Training and Doctrine Command)

Task 2: ODISC4 and SARDA will lead the development of the Army Enterprise C4I Technical Architecture.

LEAD AGENCY: ODISC4 (U.S. Army, Office of the Director, Information Systems, Command, Control, Communications, and Computers)

Task 3: TRADOC and AMC, with assistance from INSCOM AND ISC, will sponsor an initiative to refine the current Warfighting Lens Analysis (WFLA) Systems Evaluation Criteria (Scorecard) and convert it to a more detailed and comprehensive evaluation process to assess and prioritize C4I requirements.

LEAD AGENCY: TRADOC (U.S. Army Training and Doctrine Command)

Task 4: TRADOC, with assistance from INSCOM and ISC, will expand the scope of the Warfighting Lens Analysis (WFLA) process by assessing and recommending prioritization of all C4I systems to HQDA.

LEAD AGENCY: TRADOC (U.S. Army Training and Doctrine Command)

Task 5: TRADOC, with assistance from AMC, INSCOM, and ISC will integrate all C4I requirements.

LEAD AGENCY: TRADOC (U.S. Army Training and Doctrine Command)

Task 6: DCSOPS and ODISC4 will provide necessary funding for modeling and enhancement of the C4RDP process and rename it C4IRDP.

LEAD AGENCY: DCSOPS (Deputy Chief of Staff Operations)

Task 7: DCSOPS and SARDA must ensure continual integration of the Enterprise Strategy into the TAP and LRRDAP process.

LEAD AGENCY: DCSOPS (Deputy Chief of Staff Operations)

Task 8: PAED must ensure continual integration of the Enterprise Strategy into POM guidelines to the MACOMs.

LEAD AGENCY: PAED

Task 9: ODISC4 and PAED must ensure that all applicable Program Evaluation Groups are using the Enterprise Strategy as a framework to assess C4I systems.

LEAD AGENCY: ODISC4 (U.S. Army, Office of the Director, Information Systems, Command, Control, Communications, and Computers)

APPENDIX B
ARMY ENTERPRISE IMPLEMENTATION PLAN TASKS

Task 10: DCSOPS must ensure that the framework of the Army Enterprise Strategy, The Vision, is embedded into all applicable annexes of the Army Modernization Plan (AMP).

LEAD AGENCY: DCSOPS (Deputy Chief of Staff Operations)

Task 11: SARDA must ensure that the framework of the Army Enterprise Strategy becomes embedded into the Army Science and Technology Master Plan.

LEAD AGENCY: SARDA

Task 12: DCSOPS and TRADOC must incorporate the Enterprise Strategy into the Army doctrine and assign specific roles and responsibilities.

LEAD AGENCY: DCSOPS (Deputy Chief of Staff Operations)

Task 13: ODISC4 and SARDA must incorporate the Enterprise Strategy in the 25-series and 70-series publications, and begin the process of consolidating these into one series of publications.

LEAD AGENCY: ODISC4

Task 14: DCSOPS must coordinate a review of Enterprise and related DA initiatives to ensure that all tasks support a common goal.

LEAD AGENCY: DCSOPS (Deputy Chief of Staff Operations)

Task 15: DUSA(OR) and ODISC4 with DISA's technical assistance, must oversee the integration of C4I models to facilitate trade off analysis and validation of the architecture.

LEAD AGENCY: DUSA(OR)

Task 16: SARDA and AMC must continue the incorporation of the Enterprise Strategy into it's on-going review of Advanced Technology Demonstrations (ATDs) and Advanced Warfighting Demonstrations (AWDs).

LEAD AGENCY: SARDA

Task 17: SARDA must strengthen the process that effectively correlates results of ATDs and AWDs to future acquisitions.

LEAD AGENCY: SARDA

Task 18: TRADOC will initiate a program to educate and train the Army about the Enterprise Strategy Vision and the use of the 10 principles in identification of requirements.

LEAD AGENCY: TRADOC

Task 19: ODISC4, SARDA, and DCSINT will ensure that the MAISARC/ASARC/Army Intelligence Board are using the Enterprise Strategy framework to assess C4I systems.

LEAD AGENCY: ODISC4

APPENDIX B
ARMY ENTERPRISE IMPLEMENTATION PLAN TASKS

Task 20: ODISC4 and SARDA will establish a program that requires the use of Software Capability Evaluations based on the Software Engineering Institute (SEI) capability model for source selection.

LEAD AGENCY: ODISC4

Task listing and table developed from the U.S. Army, Army Enterprise Strategy Implementation Plan, version 2.5, 17 December 1993, distributed by the U.S. Army ODISC4, 21 December 1993.

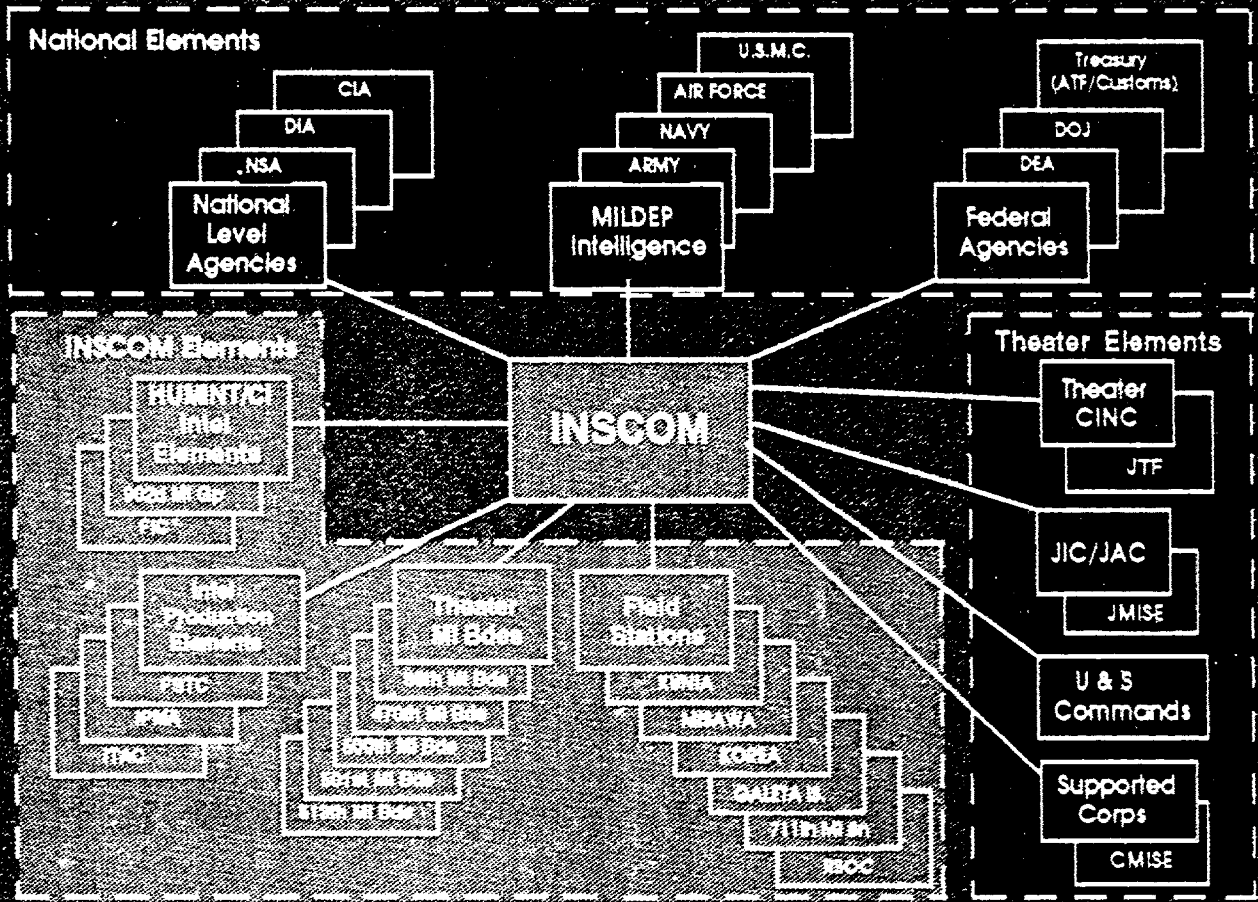
APPENDIX C
GRAPHIC REPRESENTATIONS OF U.S. ARMY INSCOM IMA.

Source: Graphics extracted from U.S. Army Intelligence and Security Command Information Management Architecture Decision Briefing, Oct 1993.

UNCLASSIFIED

IMA ARCHITECTURE

GLOBAL CONNECTIVITY REQUIREMENTS



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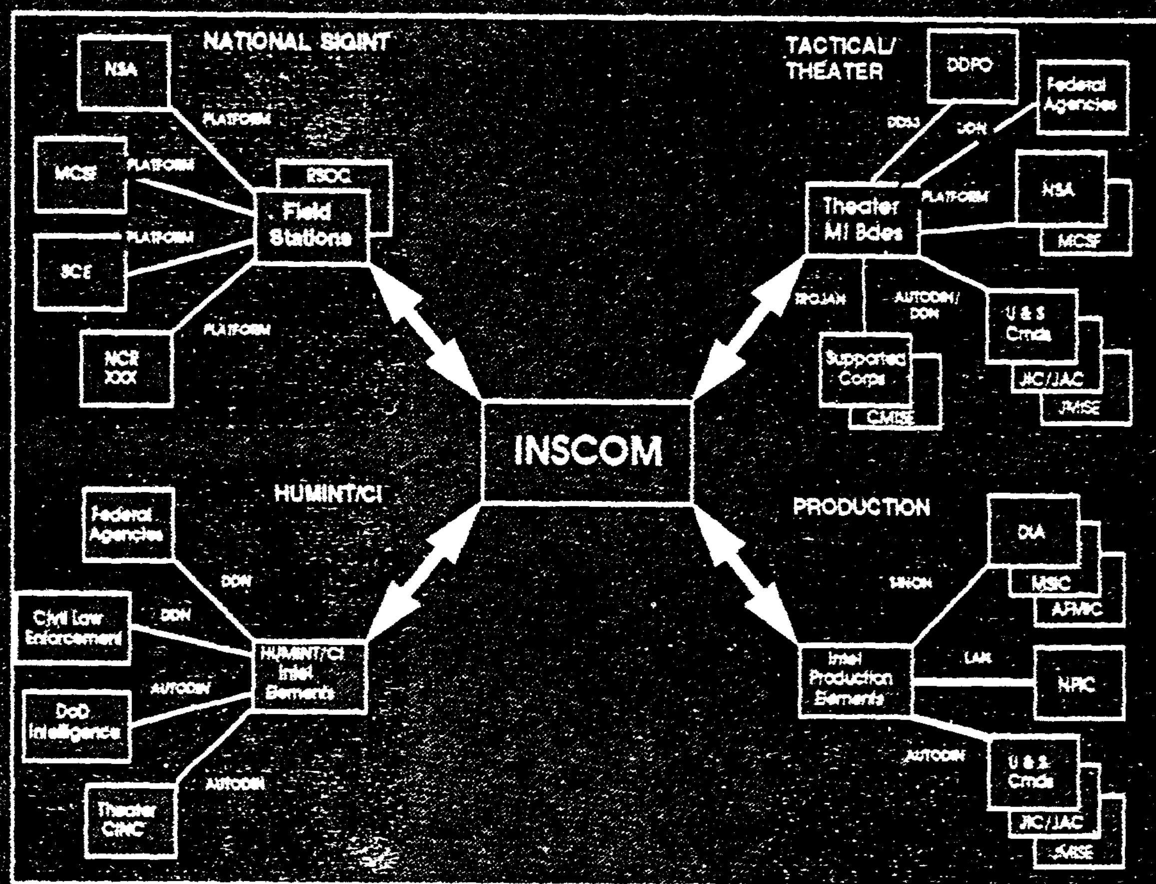
IMA ARCHITECTURE

OPERATIONAL MISSION CONNECTIVITY



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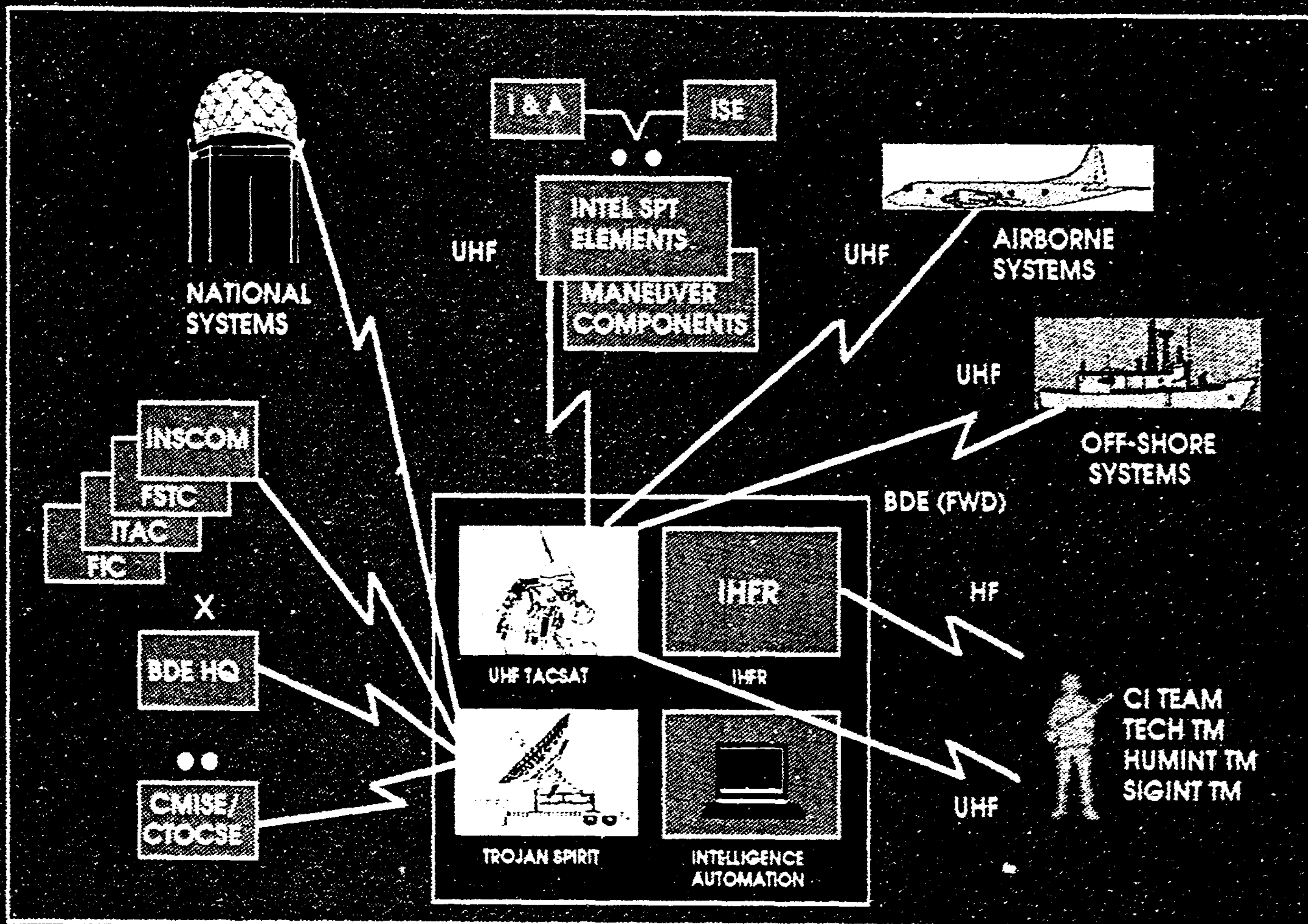
IMA ARCHITECTURE

Tier 1 Connectivity Requirements
EAC Intelligence Brigade



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IMA ARCHITECTURE

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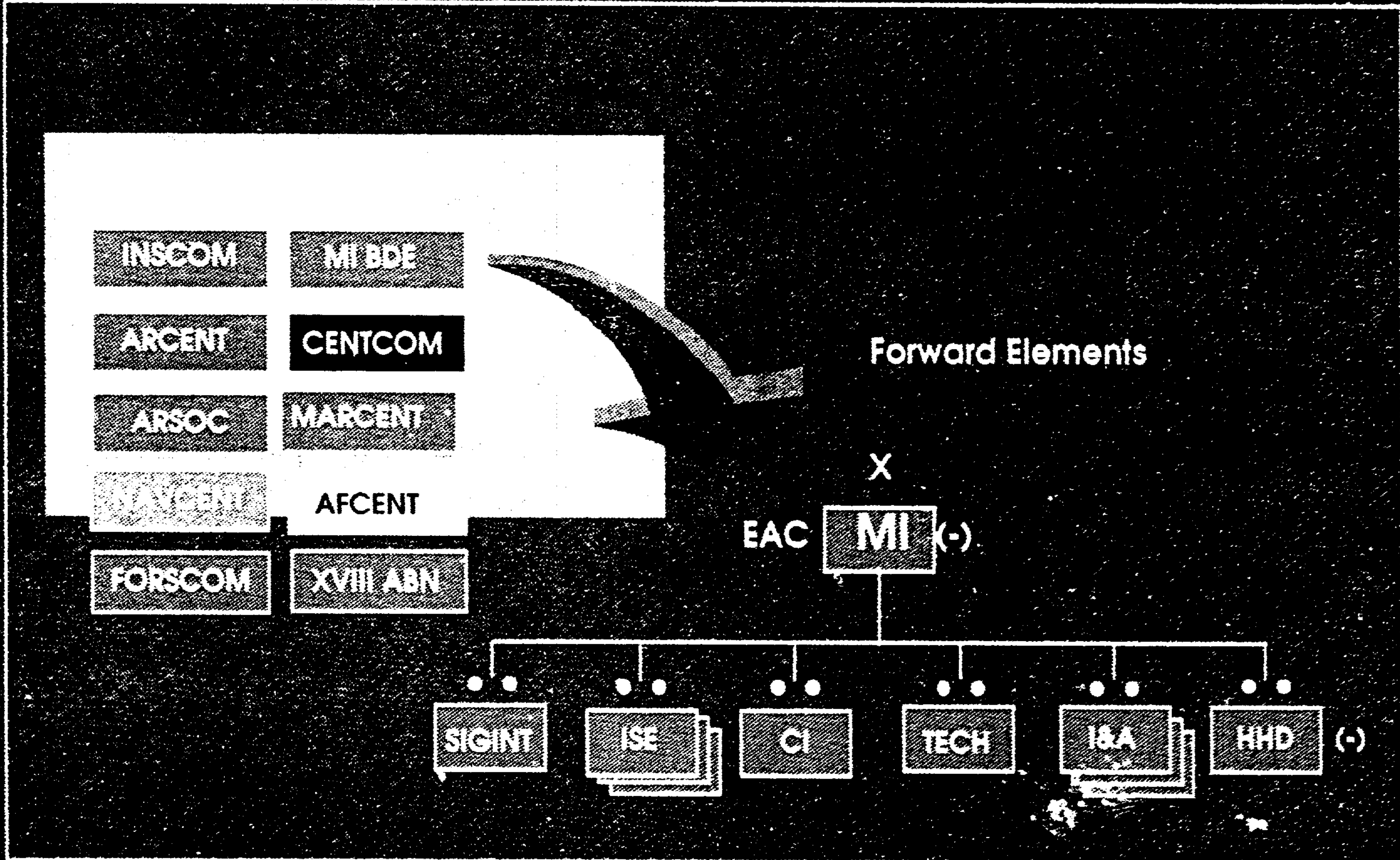

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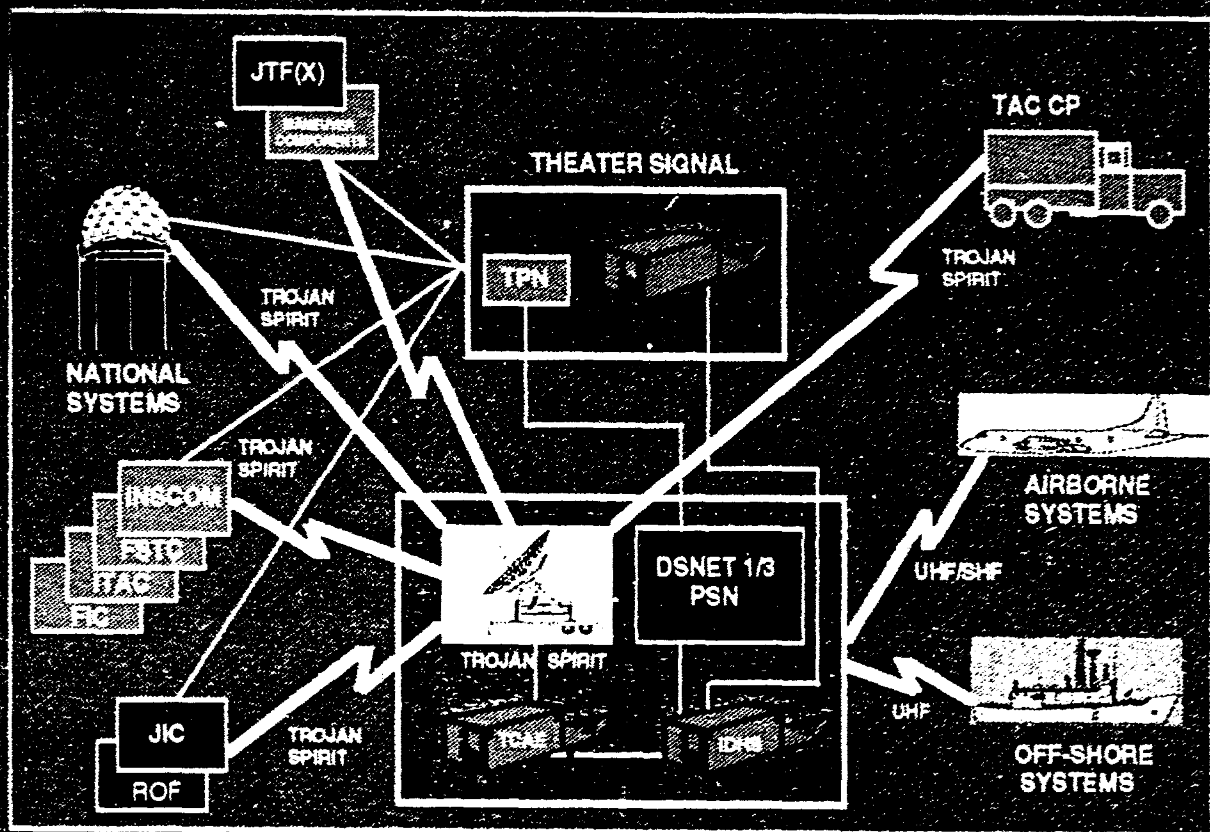
IMA ARCHITECTURE

Intermediate Level Deployment (Tier II) External Connectivity Requirements



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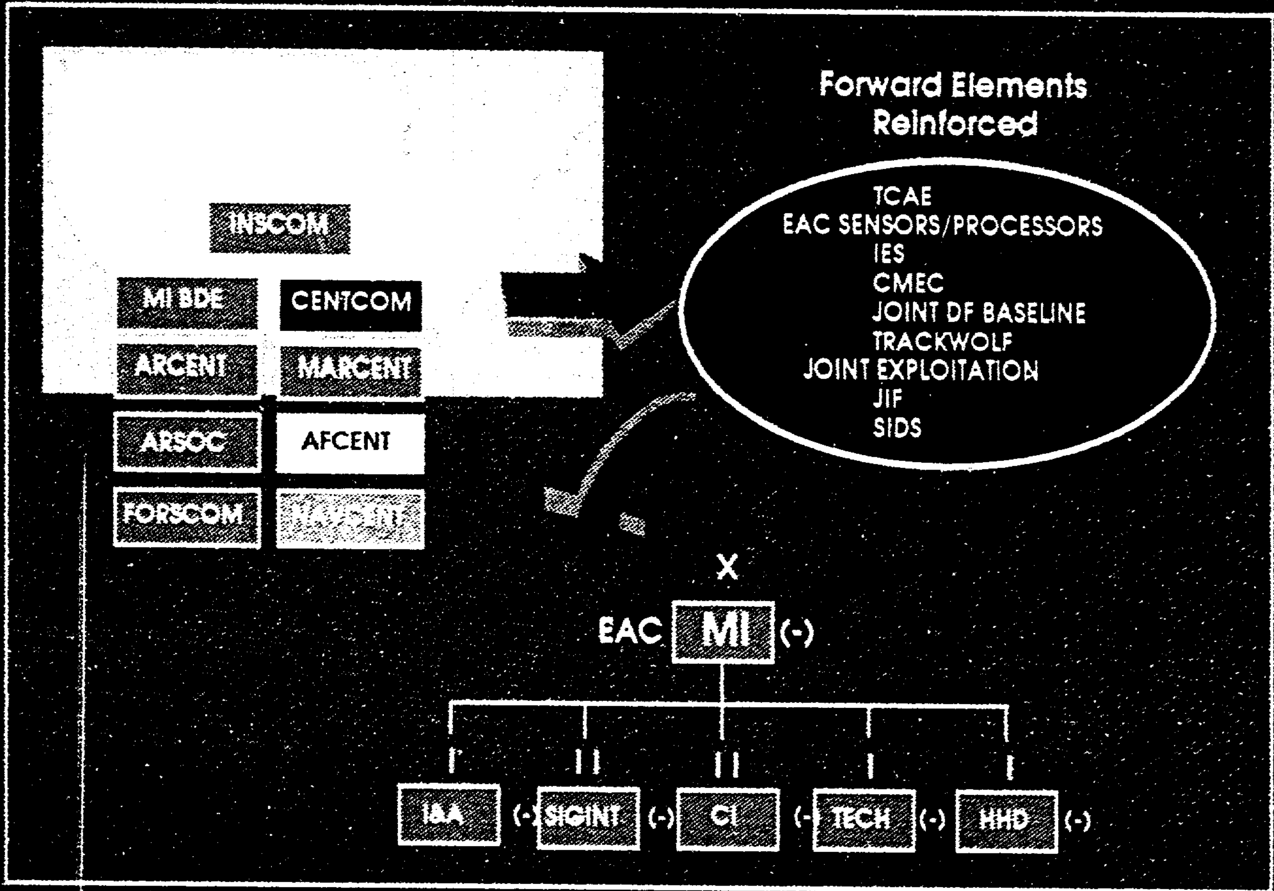
Intermediate Level Deployment (Tier II) Support



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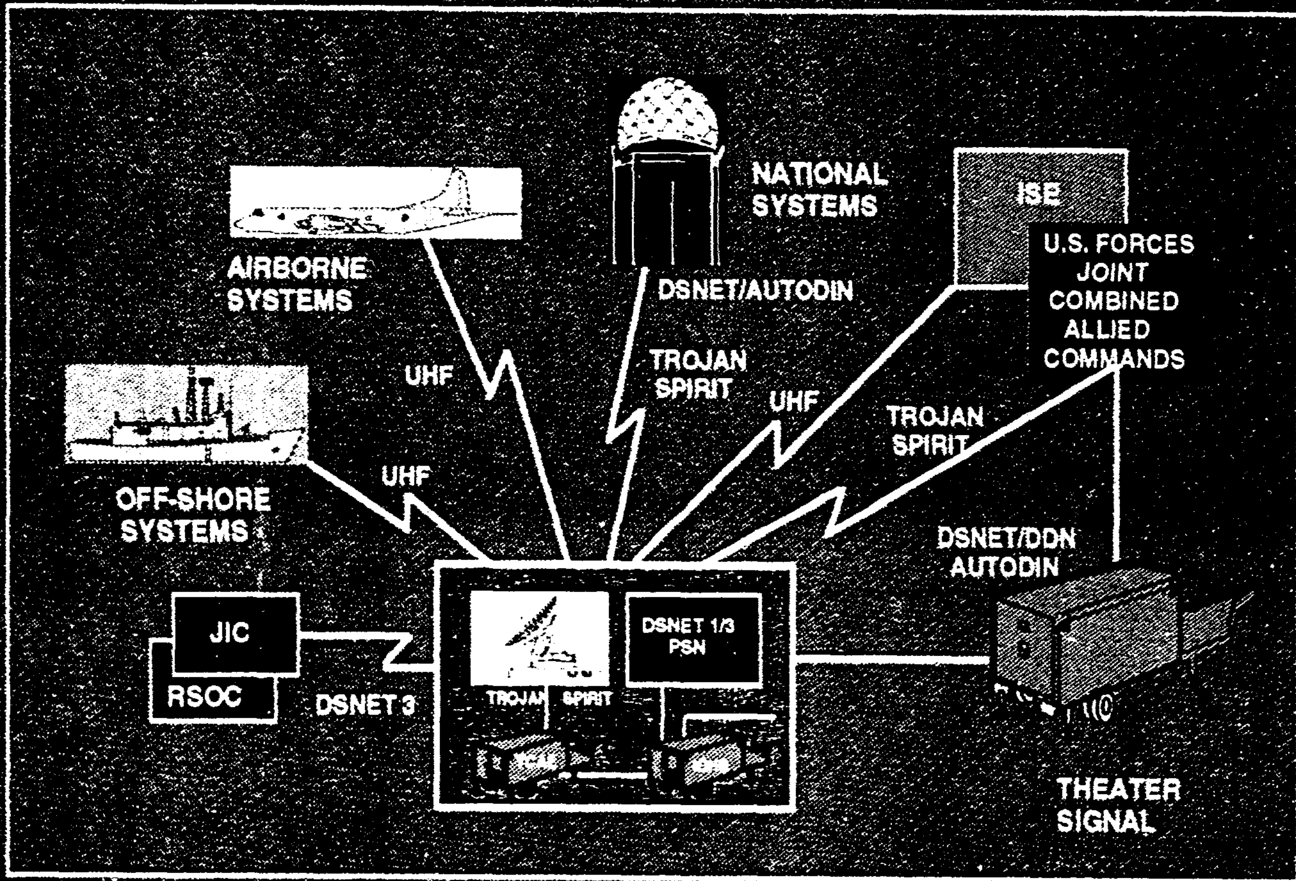
Full Brigade Deployment (Tier III)
External Connectivity Requirements



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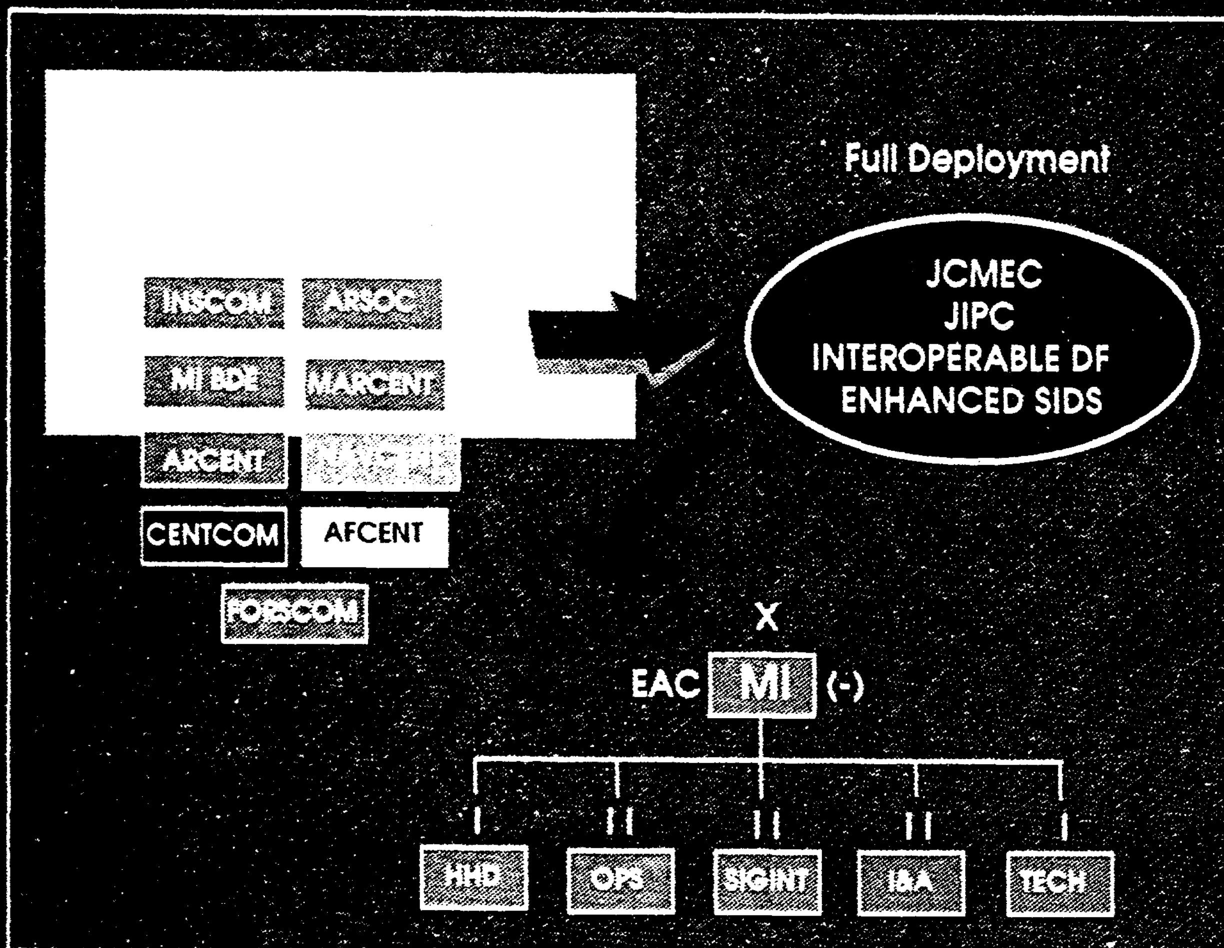
Full Brigade Deployment (Tier III) Support



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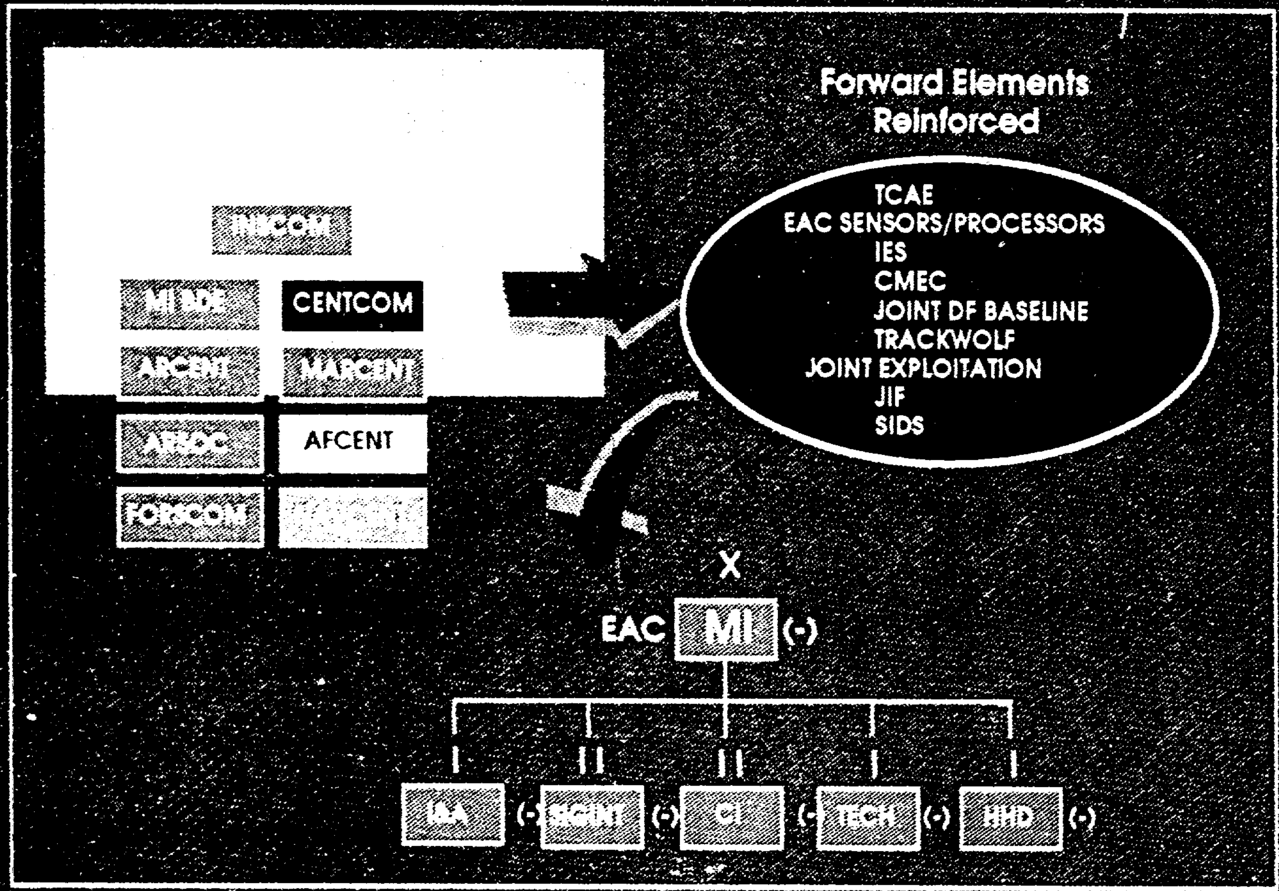
Intermediate Level Deployment (Tier II) Support



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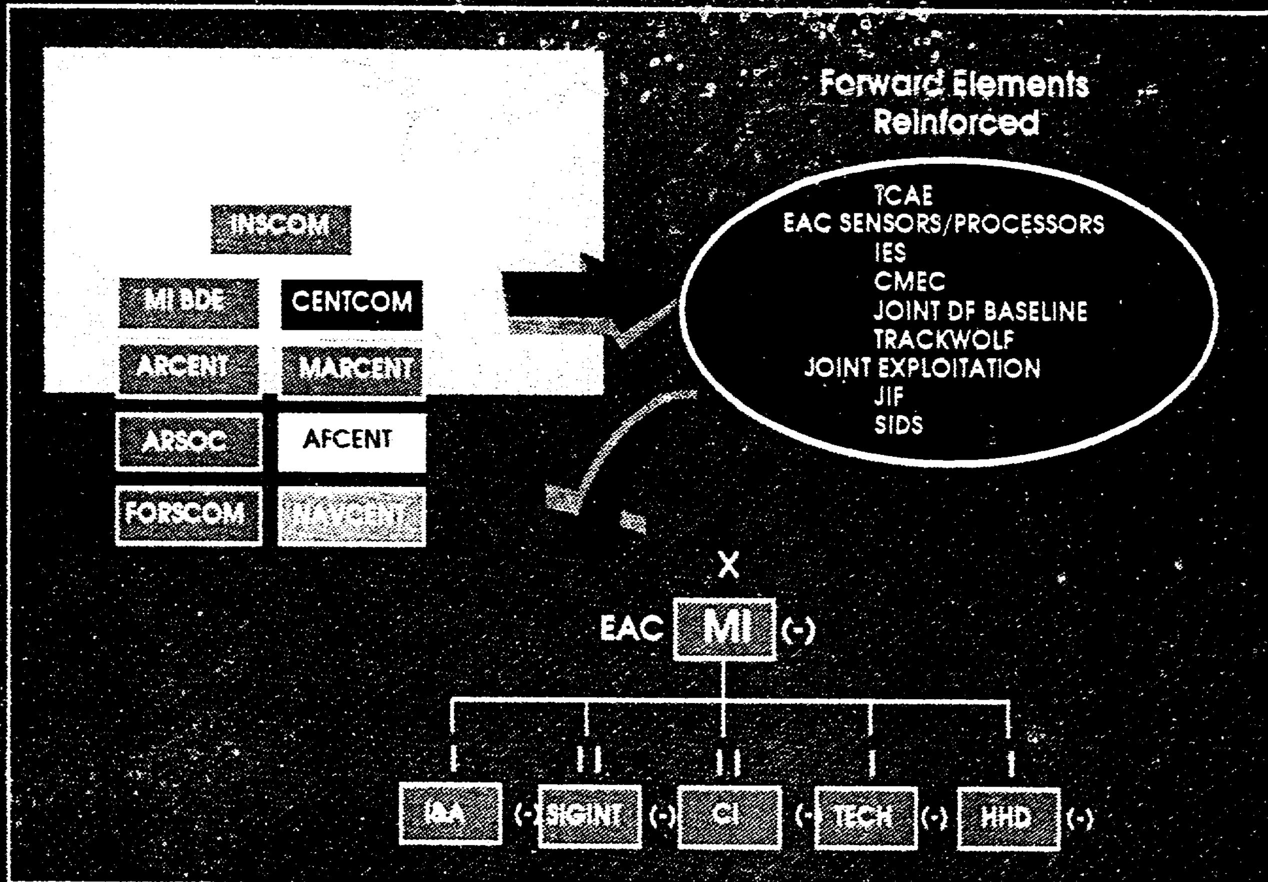
Intermediate Level Deployment (Tier II) Support



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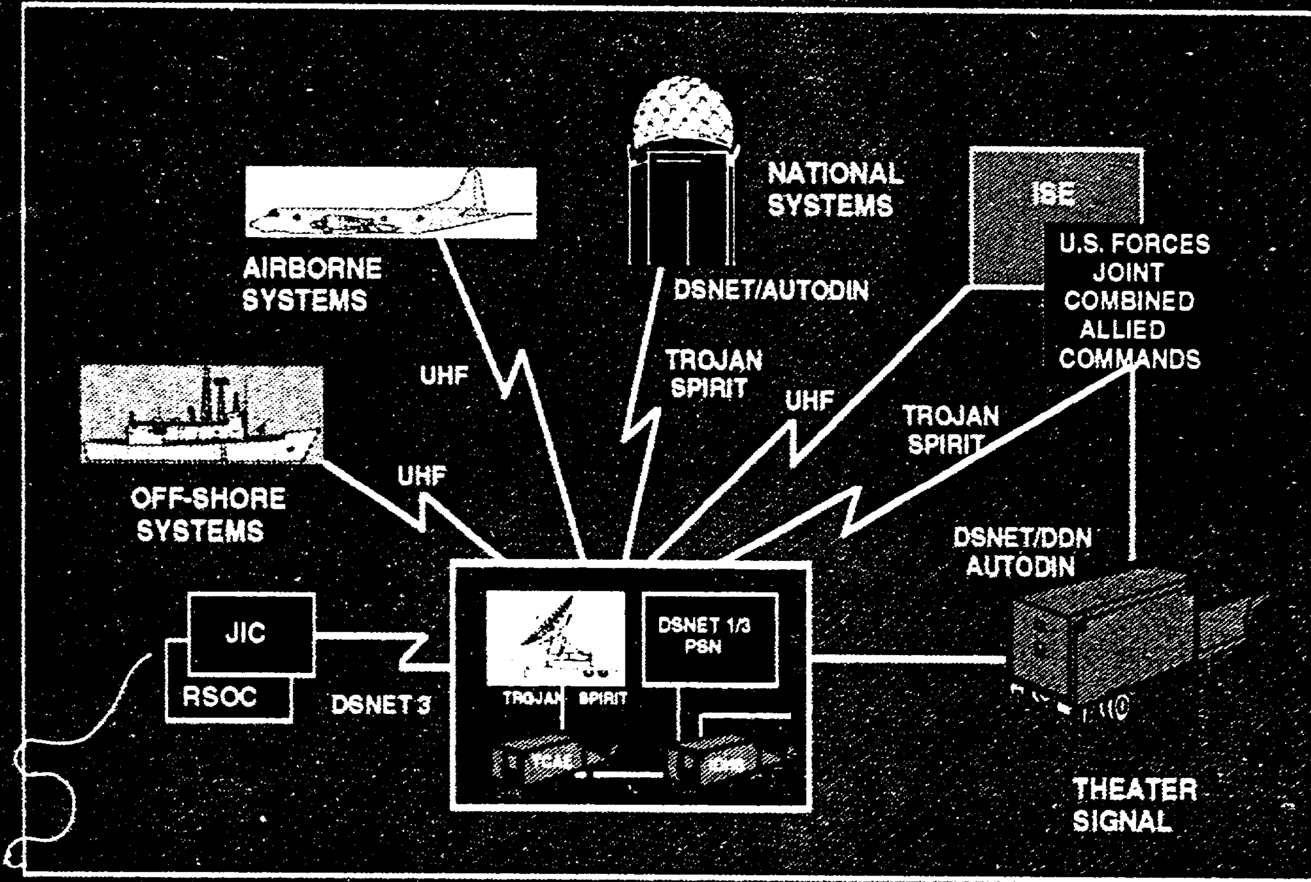
Full Brigade Deployment (Tier III) External Connectivity Requirements



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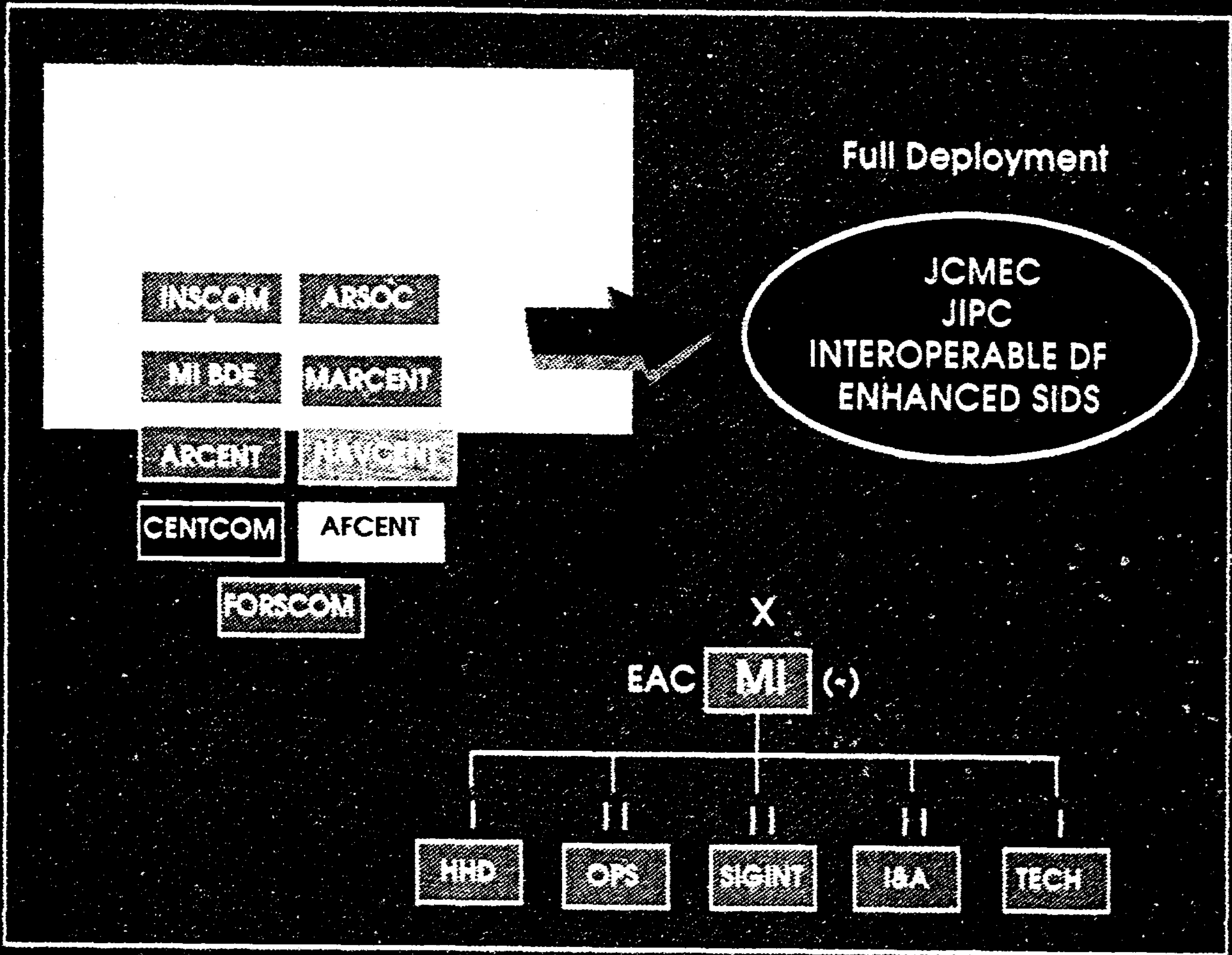
IMA ARCHITECTURE

Full Brigade Deployment (Tier III) Support



UNCLASSIFIED

93093-22

NOTES

Chapter I

1. U.S. Department of Defense, Conduct of the Persian Gulf Conflict, Interim Report, (Washington: July 1991), p.15-3.

2. U.S. Army, The Vision, (Washington: 20 July 1993), p.5.

3. Interview with Mr. Thomas Hope, Senior Telecommunications Advisor to the Commanding General of U.S. Army Intelligence and Security Command (INSCOM), Ft. Belvoir, Va: 24 January 1994.

4. U.S. Joint Staff, J6, C4I FOR THE WARRIOR, (Washington: 12 June 1993), p.1.

5. Ibid, p.1.

6. U.S. Army, The Vision, (Washington: 20 July 1993), p.10.

Chapter II

1. U.S. Joint Staff, J6, C4I FOR THE WARRIOR, (Washington: 12 June 1993), p.2.

2. Gen. Colin L. Powell, "Budget for a World Turned Upside Down," Defense 93, Issue 2, p.11.

3. U.S. Joint Staff, J6, C4I FOR THE WARRIOR, (Washington: 12 June 1993), p.4-5.

4. Ibid, p.15-26.

5. U.S. Army, The Vision, (Washington: 20 July 1993), p.1 & 3.

6. Ibid, p.10.

7. Ibid, p.1.

8. U.S. Army, The Army Enterprise Strategy Implementation Plan(Draft), (Washington: 21 December 1993), p. 19-55.

9. Ibid, p.3.

10. William E. Burrows, Deep Black, (New York: Randomn House, 1986), p.30.

11. Ibid, p.36.

12. Webster's New Collegiate Dictionary, (Springfield, Ma, G&C Merriam Company, 1977), p.1183.

13. John E. Grin, Military-Technological Choices and Political Implications, Command and Control in Established NATO Posture and a Non-Provocative Defense, (New York: St. Martin's Press, 1990), p.24

NOTES

Chapter III

1. John E. Grin, Military-Technological Choices and Political Implications, Command and Control in Established NATO Posture and a Non-Provocative Defense, (New York: St. Martin's Press, 1990), p.24

2. U.S. Army, The Army Enterprise Strategy Implementation Plan(Draft), (Washington: 21 December 1993), p.7-8.

3. U.S. Army, U.S. Army Intelligence and Security Command (INSCOM) Information Management Architecture Decision Briefing, (Washington: Oct 1993).

4. U.S. Army, U.S. Army Intelligence and Security Command (INSCOM) Information Management Architecture, (Washington: Oct 1993) p.26-35.

5. Interview with Mr. Thomas Hope, Senior Telecommunications Advisor to the Commanding General of U.S. Army Intelligence and Security Command (INSCOM), Ft. Belvoir, Va: 24 January 1994.

6. U.S. Army, The Army Enterprise Strategy Implementation Plan(Draft), (Washington: 21 December 1993), p.7-8.

7. S.L. Arnold and David T. Stahl, "A Power Projection in Operations Other Than War," Parameters, Vol XXIII No.4, Winter 1993, p. 21.

8. The Honorable Les Aspin, "The First Post-Cold War Budget," Defense 93, Issue 2, p.6.

9. Frank M. Snyder, Command and Control: Readings and Commentary, (Cambridge, MA: April 1989), p. 77.

10. U.S. Joint Staff, J6, C4I FOR THE WARRIOR, (Washington: 12 June 1993), p.22.

11. Gen. Robert RisCassi, "Principles for Coalition Warfare," Joint Force Quarterly, Inaugural Issue, Summer 1993, p.69.

BIBLIOGRAPHY

Arnold, S.L. and Stahl, David T., "A Power Projection in Operations Other Than War," Parameters, Vol XXIII No.4, Winter 1993, p. 21.

Aspin, The Honorable Les, "The First Post-Cold War Budget," Defense 93, Issue 2, p.6.

Burrows, William E., Deep Black, (New York: Randomn House, 1986), p.30-40.

Grin, John E., Military-Technological Choices and Political Implications, Command and Control in Established NATO Posture and a Non-Provocative Defense, New York: St. Martin's Press, 1990, p.24-36.

Harris, Elwyn et al, The Army's Role in Space: Support for the Battlefield Commander. Santa Monica, CA: Rand, 1988.

Jeremiah, Admiral David E., "What's Ahead for the Armed Forces," Joint Force Quarterly, Inaugural Issue, 1993, pp.25-35.

Military Air & Space Communications: 1990. edited by John P. Hyde. Fairfax, VA: AFCEA International Press, 1990.

Powell, Gen. Colin L., "Budget for a World Turned Upside Down," Defense 93, Issue 2, p.11.

RisCassi, Gen. Robert, "Principles for Coalition Warfare," Joint Force Quarterly, Inaugural Issue, Summer 1993, p.69.

Snyder, Frank M., Command and Control: Readings and Commentary, Cambridge, MA: April 1989.

Sullivan, Gen. Gordon R. and Dubik, Col. James M., "Land Warfare in the 21st Century," Military Review, September 1993, pp.13-32.

Testa, Ann M. & Jones, Walter F. The Evolving DCS. Maxwell AFB, AL., Air War College, Air University, 1992.

U.S. ARMY. FM100-5 Operations, 1993.

U.S. Army, U.S. Army Intelligence and Security Command (INSCOM) Information Management Architecture Decision Briefing, Washington: Oct 1993.

U.S. Army, U.S. Army Intelligence and Security Command (INSCOM) Information Management Architecture, Washington: Oct 1993.

U.S. Army, The Army Enterprise Strategy Implementation Plan(Draft), Washington: 21 December 1993.

U.S. ARMY. The Vision, Washington: 20 July 1993.

U.S. ARMY. Army Focus 93, Washington: 1993.

BIBLIOGRAPHY

U.S. Department of Defense, Conduct of the Persian Gulf Conflict, Interim Report, Washington: July 1991.

U.S. Joint Chiefs of Staff. Doctrine for Joint Space Operations: Intitial Draft. Washington: The Joint Chiefs of Staff, 1990.

U.S. Joint Chiefs of Staff. J6 C4I for the Warrior, Washington: The Joint Chiefs of Staff, 1993.

U.S. Joint Chiefs of Staff, JCS PUB 6-0. Doctrine for C4 Systems Support to Joint Operations. Washington D.C. 1992.

U.S. Joint Chiefs of Staff, JCS PUB 6-03.15. Data Administration in the WWMCCS Information System. Washington D.C. 1992.

U.S. Joint Chiefs of Staff, JCS PUB 6-03.6. Doctrine for Joint WWMCCS Standards. Washington D.C. 1992.

Webster's New Collegiate Dictionary, Springfield, Ma, G&C Merriam Company, 1977, p.1183.